Flash Optical Energy from the Geostationary Lightning Mapper

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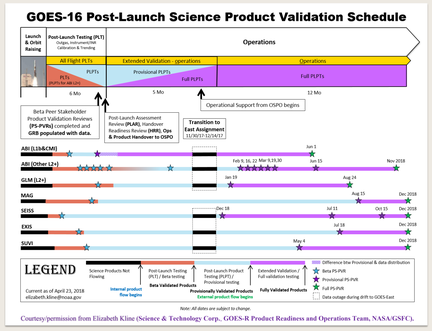
1. OVERVIEW

The Geostationary Operational Environmental Satellite - 16 (GOES-16) Geostationary Lightning Mapper (GLM) is evaluated for many months during the Post Launch Product Test (PLPT) phase in order to ensure that optimal products are available for both the operational forecasting and broader scientific research communities. An essential aspect of the PLPT phase is to obtain a **benchmark of the GLM lightning optical amplitude**, so that any long-term degradation in the nadir-staring GLM camera system can be realized and quantitatively assessed. This work provides a preliminary benchmark over a 60-day period using Provisionally Validated data.

2. SCHEDULE (GOES-16)



Courtesy/permission from Elizabeth Kline (Science & Technology Corp, GOES-R Product Readiness and Operations Team, NASA/GSFC).

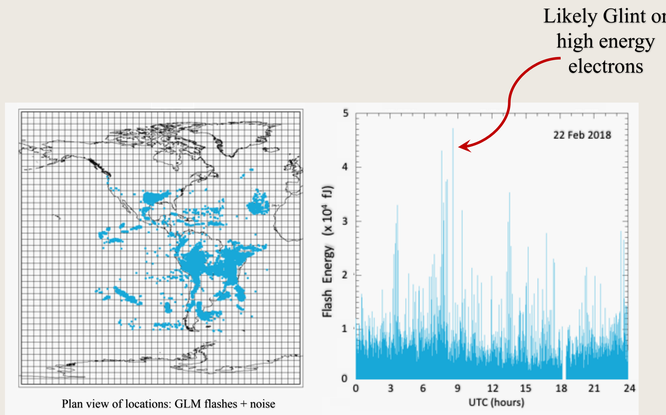
The NASA/MSFC Calibration Working Group (CWG), with guidance from the GOES-R Product Readiness and Operations (PRO) team, has successfully taken GOES-16 GLM through:

- BETA validation level (5 July 2017 to GRB)
- PROV validation level (19 Jan 2018)

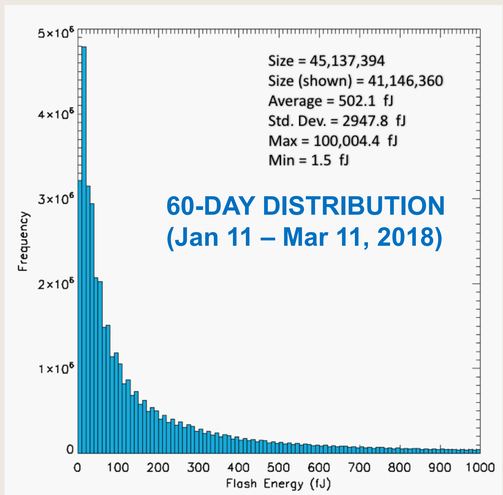
Work continues towards:

- FULL validation level (future; date in flux)

3. ONE-DAY SAMPLE AND 60-DAY FLASH ENERGY DISTRIBUTION

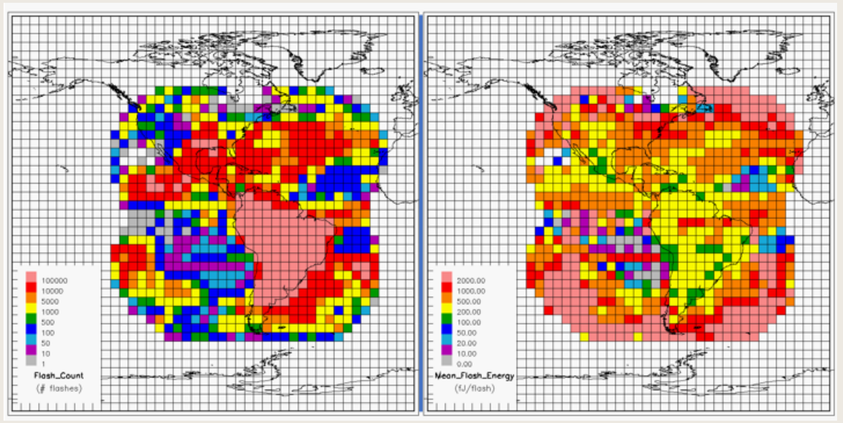


Plan view of locations: GLM flashes + noise



- Daily maps and high resolution time plots show contaminative spikes that bias results upward. [Best theoretical predictions of GLM flash optical energy based on 17+ yrs TRMM/LIS data, and accounting for orbit & instrument differences gives values of only ~ hundred to hundreds of femtoJoules.]

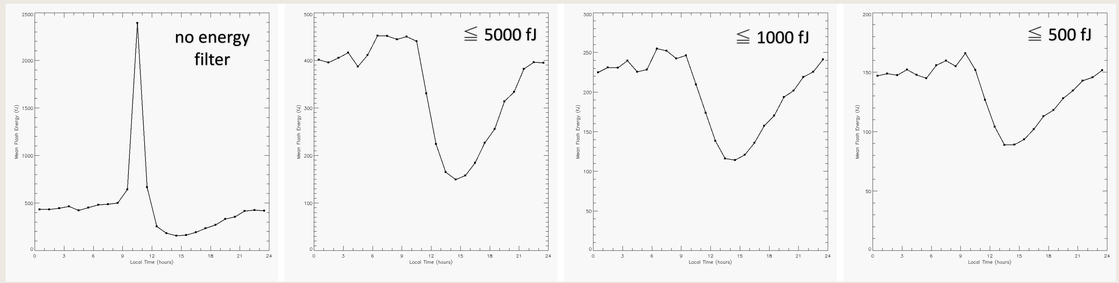
4. GEOGRAPHICAL DISTRIBUTION



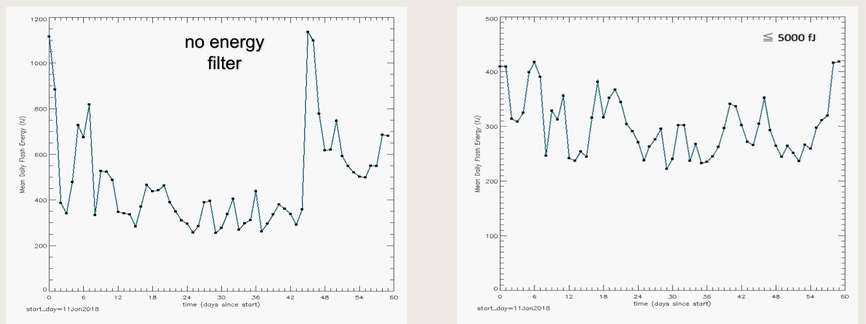
Flash Counts. **Mean Flash Optical Energy (fJ/flash).**

- 60-day period (Jan 11 – Mar 11, 2018).
- Flashes more energetic over oceans, for sufficient sample size. Agrees with TRMM/LIS findings in Beirle et al. (2014).
- Flash energy increases towards limb since:
  - pixel size decreases
  - filter roll-off
  - side/beneath cloud detection.

5. DIURNAL VARIATION (qualitatively agrees with TRMM/LIS study by Chronis and Koshak (2017)



6. PRELIMINARY BENCHMARKING OF DAILY MEAN FLASH ENERGY



Summary:

- Post Launch Test analyses of GLM flash energy has begun.
- Flash energy greater over ocean, and has diurnal variation, similar to findings in TRMM/LIS studies.
- Daily mean flash energy benchmarking over 60-d provided here is preliminary & biased high from noise yet to be removed from data.

7. REFERENCES

Beirle, S., W. Koshak, R. Blakeslee, and T. Wagner, 2014: Global patterns of lightning properties derived by OTD and LIS, *Nat. Hazards Earth Syst. Sci.*, **14**, 2715-2726, doi:10.5194/nhess-14-2715-2014.

Chronis, T., and W. Koshak, 2017: Diurnal variation of TRMM/LIS lightning flash radiances, *Bull. Amer. Meteor. Soc.* doi:10.1175/BAMS-D-16-0041.1.